"An Experiment to Measure the Gamma Ray Flux of Various Celestial Point Sources from High Altitude Balloons" by C. J. Waddington and W. R. Webber

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In the period covered by this report the gamma-ray telescope has been brought to a state of flight readiness and an attempt made to fly it from Palestine, Texas. Unfortunately during the launch phase of this flight, the telescope suffered extensive damage and the flight was aborted. At present, the telescope is being rebuilt and is expected to be ready for flight by the end of August at which time it is hoped to study the recently reported gamma ray source in Cygnus.

The initial flight of the telescope was originally planned to look at Taurus A, but because unfavoreble weather conditions in Texas caused a delay, it became necessary to switch to the quasar 3C273. The time of central meridian passage of this object over Texas in February imposed the requirement that the balloon should be launched at local dusk, a relatively optimum time for such an operation. Due to the considerable weight (about 500 lbs.) and large physical dimensions of the telescope and its orientation devices, it was necessary to use the launch vehicle (known as Tiny Tim) which was originally developed for the stratoscope project. This vehicle is a fifty ton four wheeled structure with a long cantalevered arm which can be swung rapidly out of the way at the moment of release. The telescope together with the balloon contractors equipment and ballast to maintain a level flight were all suspended from this beam, which thus carried nearly 1000 lbs. After the balloon had been laid out, but before filling with gas commenced, a wind shift of 90° occurred, but the decision was made by the balloon contractors, who are primarily responsible for the launch operation, to continue with the filling and to launch in what was anticipated to be a 3-4 knot cross-wind. In hind sight this was a questionable decision and led directly to the launch failure, but it may be defended on the grounds that there does exist a considerable probability of damaging a balloon of this size due to handling if it is re-laid. After filling had been completed the cross-wind was found to have increased to 6 knots, with a forecast that they would continue to increase. The decision was taken by the balloon contractor and the scientific representative present to continue with the launch. This meant that the launch vehicle had to turn and chase after the main body of the balloon as soon as the gas bubble was released. During this case the launch vehicle ran off the launch pad and passed over a series of earth gulleys 1-2 feet deep. At this time it was travelling at approximately 20 miles per hour and the instruments hanging on the end of the launch boom received two shocks which later tests showed must have considerably exceeded 8 g's. On the second of these shocks a load pin in the telescope mounting sheared off and the entire package dropped off the launch boom and into the path of the vehicle. The driver at this time had been jolted out of his seat and was consequently unable to prevent one of the 12 foot wheels from passing clear over the package, producing extensive damage. Later tests of a similar load pin system showed that it had a yield point at 10,240 lbs. which should have been sufficient for all normal shocks. It is almost certain that considerable damage must have been done to the telescope before it was crushed as a result of these two large shocks and that the flight would have been a failure even if the launch had been successfully completed. In particular the glass mirrors used in the spark chamber optical path must have broken. So far as we know this represents the most destructive balloon launch ever attempted.

Examination of the remains of the telescope after its return to Minneapolis revealed that the damage was predominately to the mechanical structure and that the electronics had generally survived, apart from isolated components that had been shorted out during the electrical fire that resulted. Rebuilding is now proceeding with an extensive use of magnesium structural components to produce greater strength for less weight. It is anticipated that reconstruction will be completed by August 1966 and it is tentatively planned to attempt another flight from Texas at the end of August to look at Cygnus XR-1 which has recently been reported to be a gamma-ray source having a flux of about $2.10^{-4}$ gamma-rays/$cm^2$ sec. for $E \gtrsim 100$ MeV. If this is indeed the true flux we would expect to observe several hundred gamma-rays from this source during a single flight and consequently to be able to measure the energy spectrum in some detail. Such a measurement would greatly assist in the elucidation of the physical process responsible for the creation of these energetic photons.

The financial problems resulting from the destruction of our equipment are currently being negotiated with NASA and it appears that sufficient funds will shortly be made available to complete the series of flights already contracted for. A proposal to fly this telescope on an Apollo flight was submitted to NASA at the end of March 1966.